EXPERIMENTAL CROSS SECTIONS FOR EXCITATION OF THE 2s $^2S \rightarrow$ 2p ^2P TRANSITION IN C^{3+}

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Experimental cross sections are presented for excitation of the 2s $\rightarrow$ 2p transition in C^{3+}. Use is made of the energy-loss method with merged beams. Also described is use of a multipole "electronic aperture" to discriminate against elastically-scattered electrons. Comparisons are made with previous experimental energy-loss and optical-emission data, and with results of several theoretical calculations.

Optical emission from the electron-impact excited 2p level of C^{3+} is regularly observed in solar, stellar and interstellar plasmas. The emission serves as a useful diagnostic of energy balance, opacity, and electron temperature. Presented herein are absolute excitation cross sections for this transition at energies of below threshold (7.00 eV) through threshold (8.00 eV) to approximately 1.5 times threshold (12 eV).

A description of the methods used are given in Refs. 1 and 2, and a more complete description of the data acquisition and analysis for the e-C^{3+} excitation is given in Ref. 2. Present results are given in Fig. 1, along with earlier energy-loss measurements, optical-emission results, and results in various theories.

The energy-loss method is used with merged electron-ion beams, and also using trochoidal analysis of the inelastically-scattered electrons. One problem encountered is that electrons having the same axial velocity (a low-angle inelastically-scattered electron and a higher-angle elastically-scattered electron) will "alias" one another at the exit plane. To discriminate against this, a new 16-pole "electronic aperture" was designed and tested. This aperture relies on the fact that high-energy electrons will have a larger spiral diameter in the confining magnetic field, and hence will experience a deflecting field from the coaxial rods[2]. A description of the aperture will also be presented.

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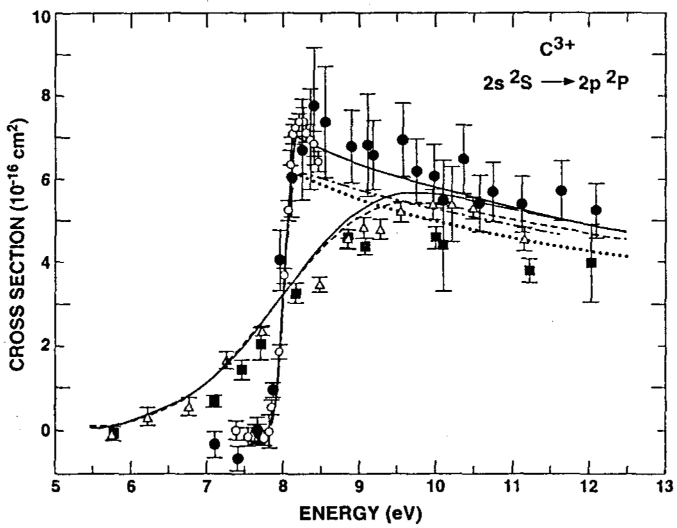

Figure 1. Experimental cross sections vs. CM energy for the 2s $\rightarrow$ 2p transition in C^{3+}. Present data are given as filled circles. Other results are energy-loss measurements near threshold[3] (open circles), optical-emission measurements as filled squares[4,5] and open triangles[6]. The solid line is a Coulomb-Born calculation[7] folded with a 0.17 eV and 2.3 eV electron energy distribution. The dashed line is a 2-state close-coupling calculation convoluted with a 2.3 eV electron-energy distribution and shifted to the correct threshold. The linked line is from a 9-state *R*-matrix calculation of Ref. 8, and the dotted line an *R*-matrix with pseudo-states calculation of Ref. 9, both folded with a 0.17 eV electron energy distribution.

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